3. $\vec{r}(t) = t^2\vec{i} + t\vec{j} + 4\vec{k}$, $t_0 = 2$

$\vec{r}\,'(t) = 2t\vec{i} + \vec{j}$

$\vec{r}(t_0) = \vec{r}(2) = 2^2\vec{i} + 2\vec{j} + 4\vec{k}$

$= 4\vec{i} + 2\vec{j} + 4\vec{k}$

$\vec{r}\,'(t_0) = \vec{r}\,'(2) = 2(2)\vec{i} + \vec{j}$

$= 4\vec{i} + \vec{j}$

4. $\vec{r}(t) = t^4\vec{i} + \sqrt[3]{t}\,\vec{j}$

$= t^4\vec{i} + t^{\frac{1}{3}}\vec{j}$

$\vec{r}\,'(t) = 4t^3\vec{i} + \frac{1}{3}t^{-\frac{2}{3}}\vec{j}$

$= 4t^3\vec{i} + \frac{1}{3t^{2/3}}\vec{j}$

$[\cos t]^5$

5. $\vec{r}(t) = \cos^5 t\,\vec{i} + \sin^5 t\,\vec{j} + e^{-t^2}\vec{k}$

$\vec{r}\,'(t) = 5\cos^4 t(-\sin t)\vec{i}$

$+ 5\sin^4 t\cos t\,\vec{j} + e^{-t^2}\cdot(-2t)\vec{k}$

$\vec{r}\,'(t) = -5\cos^4 t\sin t\,\vec{i} + 5\sin^4 t\cos t\,\vec{j} - 2te^{-t^2}\vec{k}$

6. $\vec{r}(t) = \langle t^2\cos t, \sqrt{t}, 5t\rangle$

$= \langle \underbrace{t^2}_{P}\ \underbrace{\cos t}_{Q}, t^{\frac{1}{2}}, 5t\rangle$

$P' = 2t \quad Q' = -\sin t$

$P'Q + PQ'$

$\vec{r}\,'(t) = \langle 2t\cos t + t^2(-\sin t), \frac{1}{2}t^{-\frac{1}{2}}, 5\rangle$

$= \langle 2t\cos t - t^2\sin t, \frac{1}{2t^{1/2}}, 5\rangle$